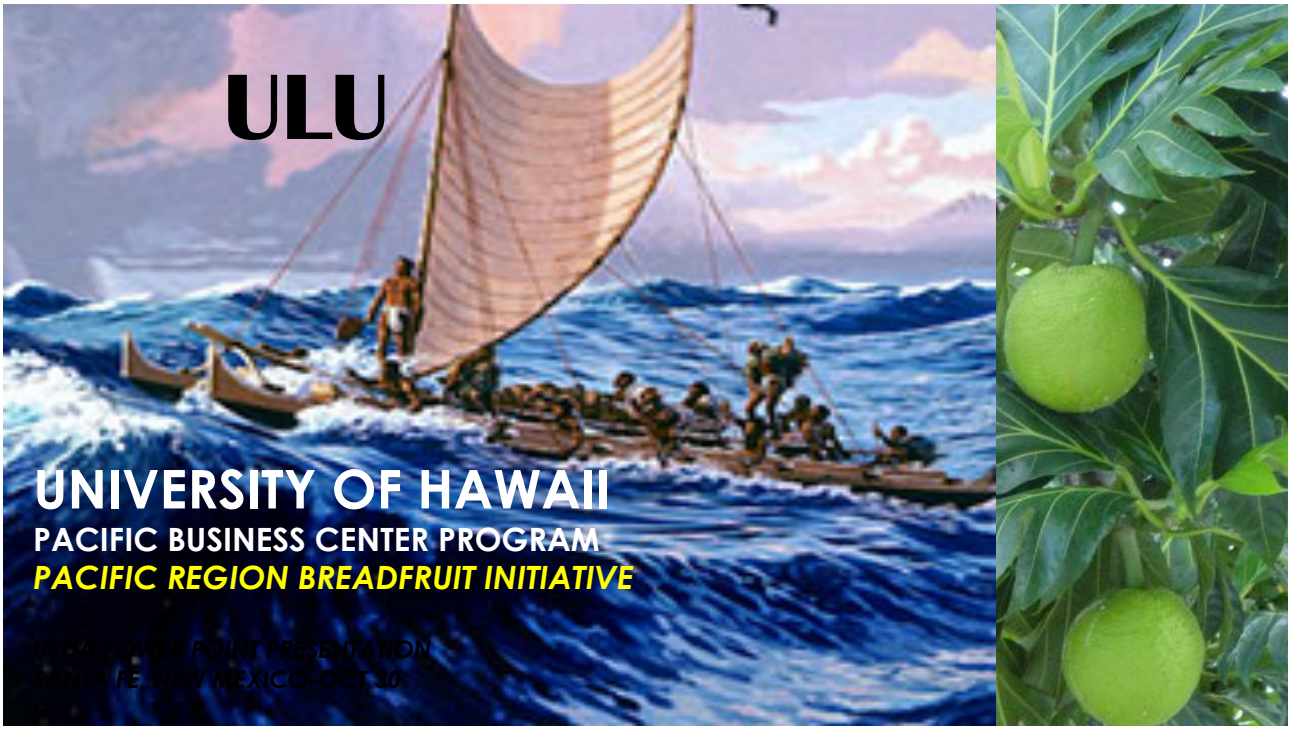
IGIA BRIEFING PAPER: UNIVERSITY OF HAWAII PACIFIC BUSINESS CENTER PROGRAM

2015 PACIFIC GLUTEN FREE BREADFRUIT FLOUR REGIONAL INDUSTRY DEVELOPMENT INITIATIVE UPDATE



This briefing report is submitted by Dr. Tusi Avegalio, Director of the Pacific Business Center Program (PBCP) and Executive Director of the Honolulu Minority Business Enterprise Center (HMBEC) both located at the Shidler College of Business Administration, University of Hawaii- Manoa campus. Both programs serve under UH Vice President John Morton, who is the Principle Investigator. PBCP is supported by the US Department of Commerce Economic Development Administration (EDA), Western Regional Office based in Seattle, Washington. PBCP is the largest EDA University Center program in the nation, serving Hawaii and the US-Affiliated Island Governments of the Pacific. The PBCP and HMBEC are winners of seven national (most recently the 2014 University Economic Development Associations [UEDA] award for the Pacific Regional Breadfruit Initiative [PRBI]), three US regional and one State award in the past ten years for their project management, technical assistance and leadership in the Pacific region. The following report is an update on the PRBI, briefly encapsulating three years of development and the feasibility of making it a reality within three years.

Agroforestry Scientist Craig Elevitch responds to a question regarding breadfruit and biodiversity in Chuuk at an assembly hosted by Xavier High School in Chuuk State, FSM. (Photo courtesy of Ivan Blanco, CNMI)

Introduction

The 2013 19th Chief Executive Summit hosted in Saipan issued an Joint Communiqué signed by the Presidents and Governors of the Commonwealth of the Northern Mariana Islands (CNMI); the Territory of Guam; the Federated States of Micronesia (FSM) and it states Yap, Kosrae, Pohnpei and Chuuk; the Republic of the Marshall Islands (RMI); and the Republic of Palau, endorsing among other things, the Pacific Regional Breadfruit Initiative (PRBI). A grant was awarded by OIA to support the initial phase of PRBI that has achieved major goals that exceeded expectations by February 2015.

Commercialization of breadfruit at an industrial scale for export has not occurred anywhere in the world, yet. Following breadfruit workshops presented by the PRBI conducted in Palau, Guam, Saipan, Majuro, Pohnpei and Chuuk, with presentations in Yap and American Samoa, from March 2014 to February 2015, it has become clear that it is feasible to begin small phased regional processing and manufacturing for export within the next three years, if not sooner. Given the current progress in product development, processing (milling, drying and packaging), breadfruit harvesting capacity, farming assessment and information sharing cross regionally from Micronesia (Pohnpei, Chuuk, Majuro, Palau, Guam, Saipan); Polynesia (American Samoa and Samoa) and Melanesia (Fiji); harvesting of existing trees supplemented by newly planted trees with a three year plant-to-harvest cycle enables the processing to begin on any island location given the resources for installation, training, operations, ware housing and transportation needs for local enterprise development. Key shipment locations are Saipan in the northeast Pacific, American Samoa in the South Pacific and Hawaii in the northwest Pacific. They are strategically located for entry into and export to the U.S. and Asian markets as key processing, packaging, transhipment and export hubs.

With the discovery that breadfruit is gluten free, the opportunity to develop and refine existing practices will provide major health, economic development, food security, sustainability and environmental benefits wherever it can be supported. Breadfruit is gluten-free (GF) and has been dehydrated and processed successfully into a flour in Samoa, Philippines and Jamaica. However, efforts to expand the processing to a sufficiently industrialized scale for the introduction of breadfruit flour in the U.S. market as a GF food product have been unsuccessful. Actually, until the PRBI, *it has not been tried*. Another compelling reason is that growing time from planting to harvest conventionally took seven or more years for the tree to begin bearing fruit. Today's propagation methods enables breadfruit trees to be harvested three years after planting.

Breadfruit Propagation for Mass Cultivation

Breadfruit has never been commercialized on a significant scale because the breadfruit tree, unlike the coconut tree, has proven difficult to mass-produce. A technique to mass-produce breadfruit plantlets from breadfruit plant tissue from the Ma'afala, a variety of breadfruit that is indigenous to Samoa and is common throughout the Pacific, was developed by research through the Breadfruit Institute of the National Tropical Botanical Garden, directed by Dr. Diane Ragone.

Thousands of breadfruit plantlets can now be produced in the lab and shipped to farmers anywhere in the world. A compelling aspect of the propagated breadfruit plantlets that significantly enhances commercialization is the plant-to-harvest time cycle is cut in half. Be that as it may, by not losing sight of the hundreds of thousands of existing trees, the implementation of processing and manufacturing initiatives within three years or less is still feasible. Therefore initiation of commercial activities based on existing trees does not depend on the introductions and planting of new trees, which are supplemental to the current tree population not replacements. Short term commercial activities hinge upon new product development, solar drying, milling and manufacturing technologies that will shortly be ready for market testing and deployment within months of this report. *Several gluten free breadfruit products are ready for market testing immediately.*

A difficult but ongoing assessment of the number of standing local trees places estimates near or exceeding one million trees from Hawaii in the Northeast Pacific; Fiji, Samoa and Am Samoa in the south pacific; FSM, Palau, Guam and the CNMI, in the central and eastern Pacific and the Republic of the Marshall Islands within the proximity of Hawaii. Prior to the arrival of Europeans in the late 1700's, the Kaluulu breadfruit groves of Kona (9 square miles) are estimated to have produced 60,000,000 pounds of fresh fruit per year or 30,000 tons/yr. If we had 900 square miles in cultivation in the Pacific, that would be 3,000,000 tons per year of fresh fruit, or 0.75 million tons of flour per year. However, with new methods of growing, planting and harvesting that assure year round harvesting, not to mention getting all the islands of Melanesia linked into the initiative, the capacity changes significantly.

Hawaii/Saipan: Main Pacific Hubs for Breadfruit Flour Manufacturing and Export to East and West markets

Several American Affiliated Pacific Islands are strategically located to serve as subregional hubs receiving dried breadfruit shipped from Micronesia, Polynesian and Melanesia. Hawaii can become the main Pacific regional manufacturing and export hub with key US Territories as transshipment spokes for ulu grown and dried from Micronesia, Polynesia and Melanesia. Likewise, production and transshipment infrastructure constructed in the Marianas will be the link to Japan and Asian markets. To meet market demand for gluten free flour, a reliable production flow of a minimum of 100,000 tons per week will be essential. *Engaging collaboratively with Oceania as a production source assures production supply no single pacific entity can meet on its own.*

Hawaii, and other Pacific Islands have land that could be turned into breadfruit food forestry orchards that can support a gluten free breadfruit flour industry. These breadfruit trees could also provide food security in the case of natural disaster. Pacific Islands, through the PRBI workshops (RMI, FSM, CNMI workshops ending last week) are aware of the rapidly growing demand for gluten-free products in the U.S., even so far as to include their endorsement of the proposed development at the recent Micronesia Chief Executives Summit on Saipan (December 4-6, 2013).

The Two Samoas Summit (held on December 5, 2012) brought together all of the pieces that are essential to developing a breadfruit flour industry – market demand; distribution networks; manufacturing expertise; export infrastructure; agricultural technology; agricultural land base – with the realization that a collaborative regional initiative can harness the collective potential and begin to create the partnerships essential for establishing a regional Pacific breadfruit flour industry. The ramifications for employment for local residents familiar with the tree and its cultivation are significant. As tuna, a pelagic marine species is impacted by the growing radioactive run off plume that is alarming in its size and drifting towards Hawaii and the west coast from Fukushima, and fish stocks being depleted without meaningful conservation, agriculturally based economic development utilizing the synthesis of modern science and traditional wisdom centered around the breadfruit is not only a more viable and healthy alternate to the tuna industry, it is safer and more sustainable.

Culturally Based Approaches and Protocols to introduce the Pacific Regional Breadfruit Initiative

Presenting the breadfruit tree and fruit within a relational, cultural and spiritual context vs leading the introduction from an economic rationale perspective signaled a more meaningful and culturally based approach to economic development in the Pacific then has been delivered over the decades. The breadfruit workshop team, which included a ranking traditional leader of Samoan ancestry and a Kahu of Hawaiian ancestry, led the introduction and opening of the regional workshops through traditional protocols of respect with humility before transitioning into the scientific, environmental, health, and economic core aspects of breadfruit workshops in Palau, Guam, Saipan, Majuro, Pohnpei and Chuuk.

Traditional leaders' response was overwhelming followed by community members who are in one way or another linked by kinship and cultural relational ties to them. Building on ancient kinship and relational ties on each island group, and between island groups, extended family representing the diversity in attendance that included farmers, fishermen, women and various associations, faith based groups, local business persons, etc. attended with the knowledge that they came under the kinship mantle of their traditional leaders. Formally organized workshops often discouraged local attendance due to assumptions of deficiency associated with socio-economic, political or religious status, education, language proficiency or lack of, having basic social sophistication or other practices associated with non local attributes often outside the norm of 'professional' gatherings. The shade of the great tree (traditional leader) so to speak, creates an entry Point for participation and empowerment, otherwise denied to those wishing to attend workshops, seminars and gatherings that tend to exude those barriers that discourage.

President Loeak of the Marshalls is also a traditional leader whose ancestors cared for exiled Samoan rebels against German colonial rule in the 1890's. (The Samoan rebels were sent to the island of Jaluit, part of the island chain that falls under his traditional title passed on by his ancestors.) In Pohnpei, a ranking paramount chief, or Nanken, of the municipality of U and a Nahnmwarki or king of the Municipality of Kiti, reciprocated the traditional protocols of respect to them and their representatives at the breadfruit workshop by hosting sakau ceremonies and extending traditional hospitality. The combined land area for both municipalities easily contained more than a third of the island of Pohnpei. Both ranking traditional leaders extended their thanksgiving for approaching in the traditional manner of respect and reciprocated with great generosity. Each leader made known to their constituencies of their support of the breadfruit initiatives and importance of working in cooperation with the local college land grant extension services program to plant and cultivate more breadfruit trees. In Chuuk, the traditional approach again opened doors through kinship ties associated with a common Samoan ancestor, Mailo who is mutually revered as a great warrior in both archipelagos. (The great great grandson of Mailo, received the maafala breadfruit trees from a descendent of Mailo of Samoa who led the breadfruit team to Chuuk.)

US Market Demand

In the U.S. the demand for GF food and beverage products has increased astronomically since 2008, going from $1.54 billion to an estimated $3.31 billion in 2012 by Gluten Free Foods and Beverages Market: Trends and Developments in the U.S. 4thed. There is also a more recent (2014) estimate of $10.5 Billion in 2013 to projections of $15 billion in annual sales in 2016 according to Mintel, a market research company. "In dollars and cents, sales of gluten-free products were expected to total $10.5 billion last year, according to Mintel, a market research company, which estimates the category will produce more than $15 billion in 2016" (New York Times, 2014). The largest part of this market is baked goods and snacks that substitute GF flour for wheat flour. A gluten free beer has also hit the market and gaining in popularity. Local breweries may want to investigate that potential.

The push for new and improved GF products in the market continues. Used for years by patients suffering from celiac, an autoimmune disease causing some adults and children to have adverse reactions to gluten, the general population now understands the health benefits associated with cutting gluten out of their diet. Gluten-free diets work well for those concerned with digestive health, which has gluten sensitivity or those that follow the "free from" trend. Because of this, many companies like General Mills are creating gluten-free options.

There are wonderful opportunities for the Pacific Islands and local companies to venture into the gluten-free territory as leaders in the propagation, farming, processing, product development and manufacturing of breadfruit and byproducts. In time, Pacific Islanders can become the technical consultants to countries throughout the world seeking to cash in on the wonders of this Pacific tree.

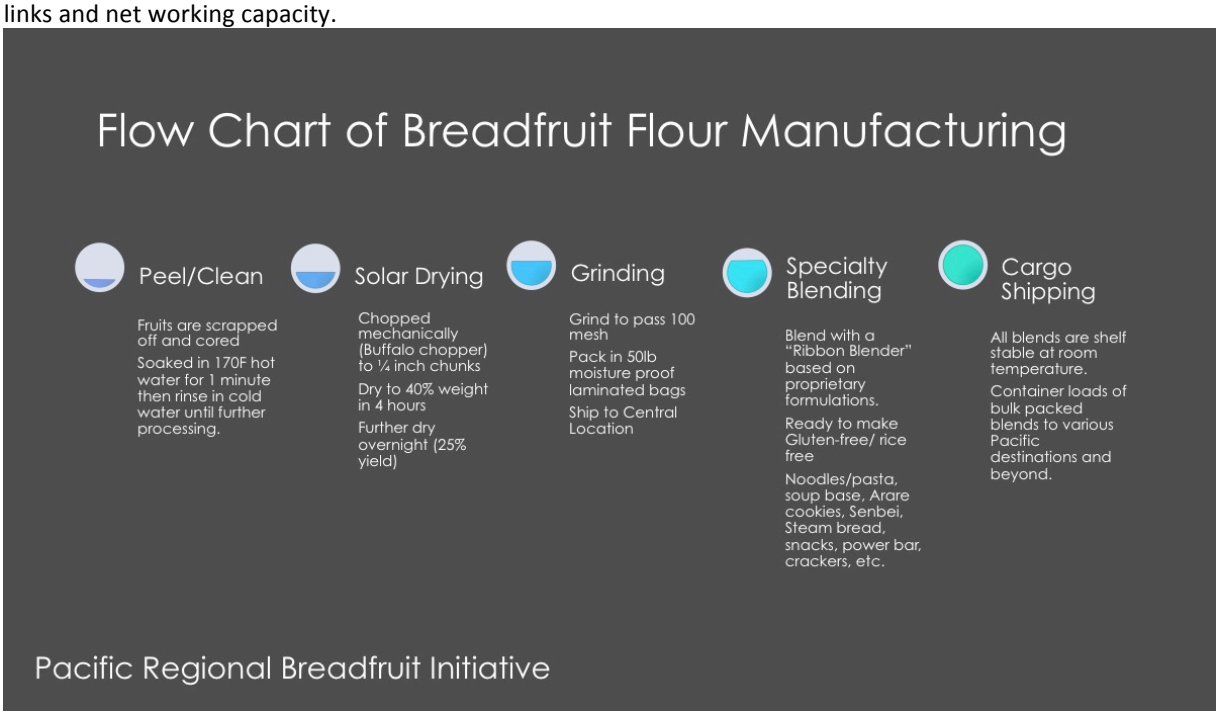
The major distributors of GF products in the U.S. know very little about breadfruit and its potential as a source of GF flour. Sean Nelsen, representing FoodSource C.H. Robinson, one of the largest logistics and distribution companies for food products in the U.S., featured the GF market and distribution strategies and potential growth demand for the GF products in American Samoa (12/2012), where the first of two regional breadfruit summits were held initiated by PBCP

in collaboration with the host governments. Having SubWay and Trader Joe's as two of their clients speaks to the Company's expansive reach and support of the healthfood movement in the U.S. Breadfruit flour products from the Pacific have yet to be introduced into the US Market and strategic marketing plans are being developed concurrently with continued food research and processing to flour.

Product Development and U.S./Global Gluten Free Market

The 2015 project goal is the ordering, installation, training and operating of essential processing and manufacturing equipment needed, for the formulation mixing of breadfruit flour and fresh cocoanut cream by September. Attending food fairs to observe and establish links to buyers, distributers and supply chain technical resources through partnerships linked to the U.S. and Asia markets are in process. Introduction of gluten free breadfruit based products will be initiated by March 2015. Small production packaging infrastructure for export capabilities is expected to be in place by December 2015 in island locations where agricultural extension and land grant programs are collaborating effectively with local farmers, local businesses, government commerce offices, and resident associations and interests. Gluten free breadfruit flour include pasta, gluten-free snacks (rice crackers without rice), steam bread, tempura breading, pizza crust, etc.

The following is a flow chart for breadfruit flour manufacturing that can be scaled depending on distance, transportation links and net working capacity.



Other Commercial Benefits: The sap from the Ulu is high in organic latex, and contains properties currently under research with promising potential. The significance of latex research is underscored by a 3 million dollar grant to Ohio State University to research the extraction of latex from dandelions. Organic compounds of the male breadfruit inflorescence (flower head) is nearly 60% more effective than the leading synthetic pest repellent. Studies by scientists at the USDA Agricultural Research Service (ARS) and Canada's University of British Columbia identified three compounds extracted from the flower that repel mosquitoes more effectively than the leading commercial repellent. The Deployed War-Fighter Protection Research Program, which develops and improves methods to protect our U.S. military personnel against insects that transmit diseases such as malaria, yellow fever and dengue fever are now aware of the breadfruit flower. The anticipated demand for a commercialized product is compelling. The health benefits are equally astonishing. Breadfruit is not only gluten free; its vitamin A is one of the highest among plants or fruits. This is significant in that Vitamin A deficiency (VAD) is one of the most common and devastating micronutrient deficiencies in the world and is especially common in tropical developing nations. With obesity epidemic, particularly in the US-Affiliated Pacific

States, breadfruit consumption replacing imported staples and sugar-laden foods, i.e., rice, confections, bread, etc., can curb the upward spiral of diabetes, heart disease and hypertension endemic in the region. Breadfruit is high in complex carbohydrates, low in fat, and cholesterol and gluten free. It has a moderate glycemic index (blood sugar shock) compared to white potato, white rice, white bread, and taro.

Food Security and Climate Change

Traditional history, cultural practices and a spiritual mind set that sees nature as a seamless part of life may offer the pathway to resilience and survival with the advent of global climate change and rising tides of which the islands of the Pacific are at high risk. Sea faring ancestors, among the most resilient humans in a world of water, learned and taught methods of survival and sustainability that have been passed on to modern generations yet often overlooked and or supplanted with more modern means of disaster preparedness developed for other regions, conditions, geographies and cultures. No where is there cultural based food security and climate change disaster preparedness and community resilience strategy where pacific islander wisdom knowledge and expertise is woven with modern knowledge and science associated with survival in Oceania. Nothing is more amusing then academics and scientist with no knowledge or experience of pacific islands survival methods and resilience, conduct community resilience and food security practices developed elsewhere with no intention of it being applied to an atoll in the middle of an ocean.

Consistently, throughout Melanesia, Polynesia and Micronesia, the food security core practices that can sustain survival are in plant life forms such as the breadfruit, the pandanus and the coconut. How and why they were grown, the different varieties and where to grow them and their purpose are the keys to how our sea faring ancestors survived milleniums of criss crossing the greatest body of water on earth in stone carved double hulled voyaging canoes made of breadfruit wood planks held together by coconut husk rope sennit and caulked with breadfruit sap, and sustained by water held in large coconut shells with tapa plugs. Breadfruit tree's have been reported continuing to fruit in areas suffering a nine month draught where all other traditional foods, i.e., bananas, taro, kasava, yams, etc., have shriveled and died. Breadfruit varieties also are found feet away from the ocean, having the ability to survive high salinity ground conditions where all other traditional food crops (taro, banana, yams, papaya, ufi, kasava, etc.) will not survive. Pandanus varieties were deliberately cultivated and carried by voyagers for specific nutritional and survival purposes, particularly in Micronesia. Juice and food from the pulp of specific varieties grow from the pandanus, that like the breadfruit and coconut tree, is incredibly resilient with the ability to withstand drought, strong winds, and salt spray. Each of the trees provide shelter, medicine, food, water, clothing, tools and sea crafts, sails, and all manner of basic survival needs that are sustainable, as what is harvested grows back. Disaster preparedness and survival kits are not sustainable. Once a food package or water container is used it does not grow back. The Pacific Business Center Program works collaboratively with the UH National Disaster Preparedness Training Center (NDPTC) as a resource for cultural based food security and climate change resiliency planning for the Pacific. PBCP is also actively collaborating with national native American organizations led by Haskell Indian Nations University in Lawrence, Kansas on indigenous wisdom and practices associated with nature, natural disasters and survival utilizing indigenous knowledge, skills, abilities and experiences.

Tapping the Scientific, Research and Technical Expertise of the US University EDA (Economic Development Administration) network

The EDA National University Center program links the top university technical and scientific expertise in the nation, providing state of the art technology, research, engineering and scientific know-how to support the growth and strength of American economic development and initiatives that include the US-Affiliated Island Governments of the Pacific. Two examples are the linkage to Kansas State University, that specializes in flour processing and technology for the US Department of Agriculture and major food production manufacturers in the US, and the need to design requisite food engineering and technologies for breadfruit and other agricultural products of the Pacific.

There will be a need to design a production facility that is appropriately scaled (and scalable) for the volume of production required that takes advantage of the most economical, efficient technology and production equipment that is currently available and is appropriate for Hawaii. This production model would include applications of recent advances in solar technology that will allow tons of breadfruit to be dried continuously as well as economically at the farm level without the use of conventional sources of electricity. PBCP working with Professor Jeff Gwirtz of the Advanced Manufacturing Institute (AMI) and the International Grains Program (IGP) at Kansas State University who is a national

and internationally known expert in the field, and Food Science Professor Alvin Huang of the UH College of Tropical Agriculture, a leading international expert on tropical food products, will have a recommended breadfruit prototype drying and processing mill that can fit into a shipping container for remote deployment within the next 10 months.

Partnership for Mutual Benefit: Building on Kinship, Cultural Ties and Existing Strengths
The agricultural land available for increasing the production of breadfruit is insufficient for supporting a new breadfruit industry at the national scale. A regional industry strategy will more than support the demand with key sub regional hubs linked to Hawaii. Consequently, partnering with Pacific Island neighbors brings to the table substantial agricultural land capacity in support of the breadfruit initiative.

Sharing the Benefits with Individual Families, Villages, Pacific Island Neighbors and Caribbean Islands.
As a compelling form of community based economic development, the old copra drying and collection model may be an excellent method for the average family and village to earn a supplemental income from collecting and drying of Ulu for district collectors to weigh and purchase on the spot. Families can earn as much as they want depending on market value and cost of production for dried breadfruit. Considering the spiraling demand for gluten free food products, this income source can be significant. The significance of traditional agroforestry cross cropping and multi-tiered planting vs. monocropping has been validated by agroforestry experts and research. It maximizes land use and environmental balance while minimizing disturbance to traditional island farming and culturally based life. Community based economic development also assures benefits are shared broadly among the village and community residents along coastal and inland areas.

US Territories in the Caribbean. As much of the research, experimentation and applications of breadfruit cultivation and propagation work has been done on islands in the Pacific where the breadfruit originated, the work and results can be transferred easily to the US Territories in the Caribbean and elsewhere where the breadfruit can grow and thieve. The template from the Pacific can benefit human society globally to feed the hungry, improve health, restore environmental stability, generate economic benefit and promote peace. It is more than a fruit; it is a gift of life.

Much of the research testing and design work will have been done by a process no single community entity can afford, yet the benefits from linking to a regional breadfruit development industry would jump start many island communities that can support the developed model. The model addresses transferability and scalability of the manufacturing and processing model for easy community access and use. The broader island community benefit will encourage communities to form clusters to share a community-processing model.

Like spokes on a wheel, this model is linked to the central commercialization processing and manufacturing center for each island for export and shipping that can be consolidated in American Samoa in the south Pacific, Pohnpei (FSM) in the Central Pacific and the Marianas in the far east Pacific, all supply-chain linked to the shipping and distribution hub in Hawaii for manufacturing and export to multiple destinations on the west coast, and Saipan for the Asian market. This is just a concept model discussion, but one that is viable given the looming demand for gluten free foods in the US market. As each jurisdiction develops in this systems approach, expertise will facilitate local capacity to move it towards greater self-sufficiency to engage markets at its discretion. For now, all regions and governments need to work together collaboratively to move the regional breadfruit initiative forward. We can sail with the wind or turn into the wind and reach for shores yet untouched.

Breadfruit Product Introductions to Food Expos and Conferences: Breadfruit can be used in so many different ways (gluten free flour for breads, crackers, chips, pasta; as a supplement for high protein drinks; as a source of latex; as a source of insect repellant, etc.). Attending Food expos in the U.S. and Asia will also be outlets for featuring Pacific Breadfruit products that expands awareness, interest and will stimulate demand that resonates back to the islands.

Mahalo:
PBCP has initiated the breadfruit initiative for over three years, often with limited or shared resources to achieve the current level of development. PBCP looks forward to collaborating with Territorial, State, Higher Education and Community organizations interested in the development of Ulu in the Pacific. It is conceivable that a local breadfruit

industry in any or all of the territories can be fully operational within three years given the resources to operationalize and support the initiative in the realization of that goal. Mahalo Papalii Dr. Tusi Avegalio

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